# BOGOLYUBOV, Nikolay Nikolayevich

[Lectures on quantum statistics; problems of statistical mechanics of quantum systems] Lektsii s kvantovoi statystyky; pytannia statystychnei mekhaniky kvantovykh system. Kyiv, Radians'ka shkola, 1949. 227 p. (MIRA 12:7)

# BOGOLYUBOV, N.H.; TYABLIKOV, S.V.

Self-energy conservation in the nonrelativistic field theory.

Dep.AN URSE no.5:10-16 '49. (MIRA 9:9)

1.Diyeniy chlen AN URSR (for Bogolyubov).2.Institut matematiki AN URSR.

(Field theory) (Force and energy)

BOGOLYUBOV, N. N.

PA 32/49T54

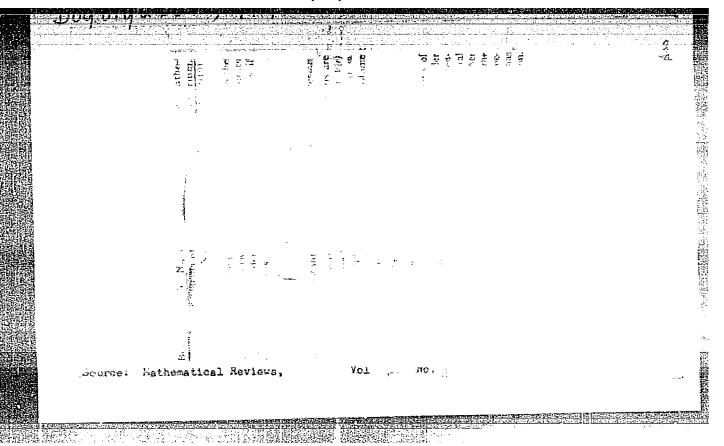
USSR/Mathematics -- Perturbation Method Mar 49
Physics -- Atomic Structure

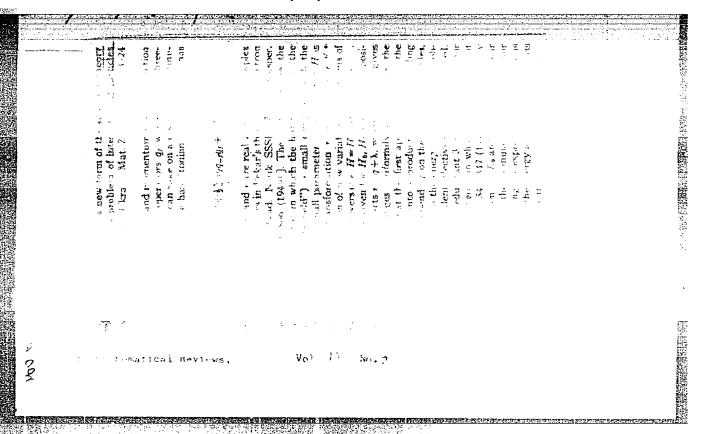
"One Application of the Theory of Perturbation to the Polar Model of a Metal," N. N. Bogolyubov, S. V. Tyablikov, Math Inst, Acad Sci USSR, 5 pp

"Zhur Eksper i Teoret Fiz" Vol XIX, No 5

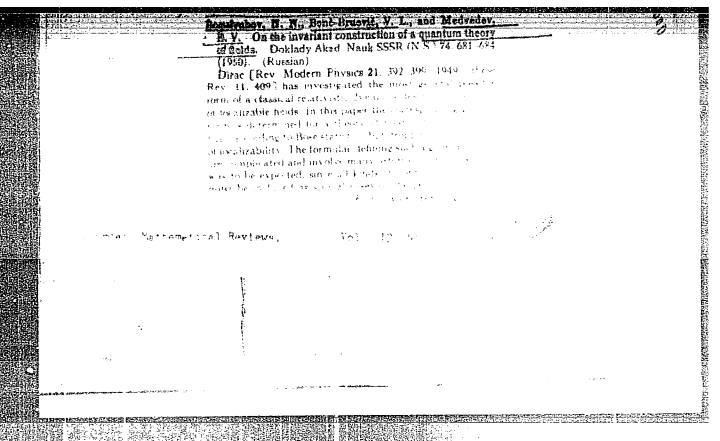
Presents results of one form of the theory of perturbation for a degenerate level applied to the polar model of a metal. Develops simple method enabling results of theory of perturbation to be used without recourse to method of secular equations.

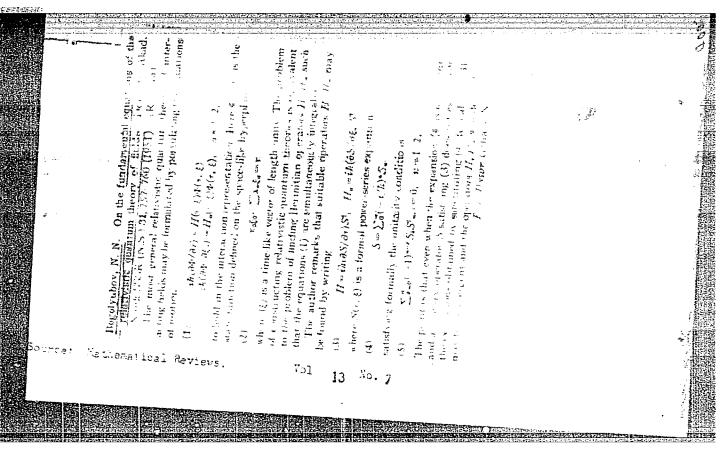
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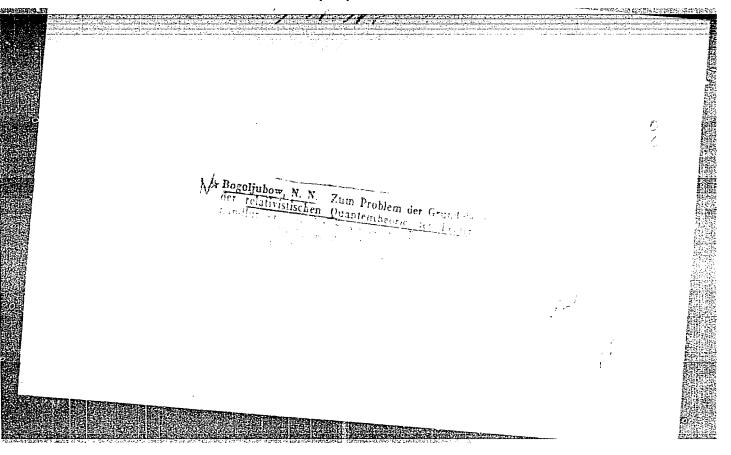


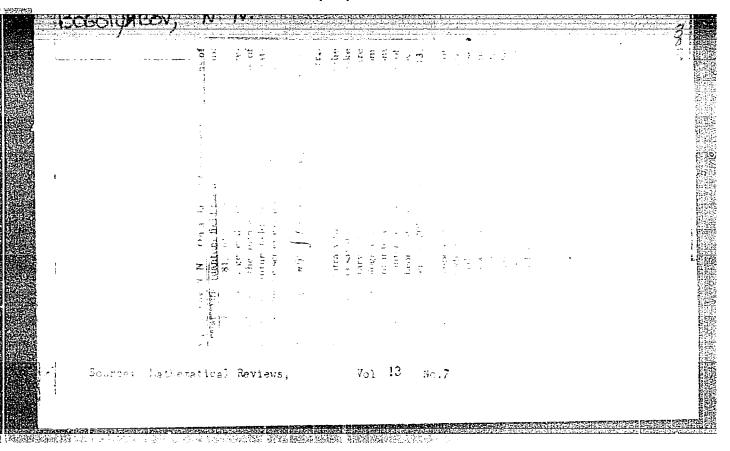


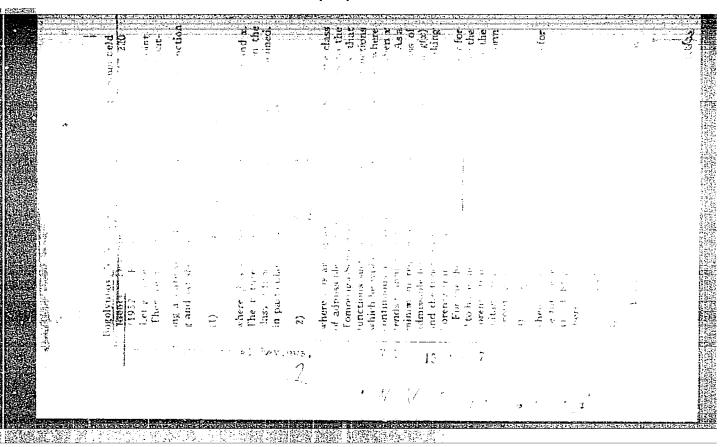
BOGOLY	UBOV. A	(.H.			
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(8)	$Q = \sum_{i=1}^{n} (\eta^{i} x^{i}) \int Q(\eta^{i} x_{i}^{i}) = F(x_{i}) dx_{i} = dx_{i}$	and the state of t	
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	min: Mathematical Reviews, 1977 Vol	13 %. 7	

USSR/Mathematics - Physics

Card 1/1 Pub. 22 - 10/40

Authors : Bogolyubov, N. N., Academician

Title : On the presentation of Green-Shwinger's functions by functional integrals

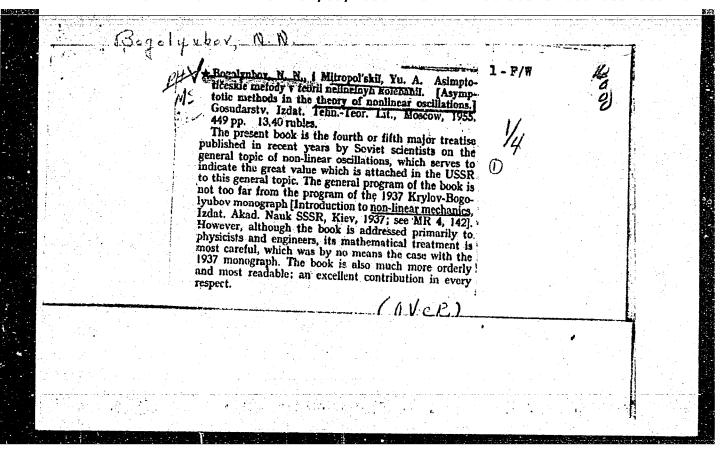
Periodical : Dok. AN SSSR 99/2, 225-226, Nov 11, 1954

Abstract : A method is presented for an interpretation of Green-Shvinger's functions by

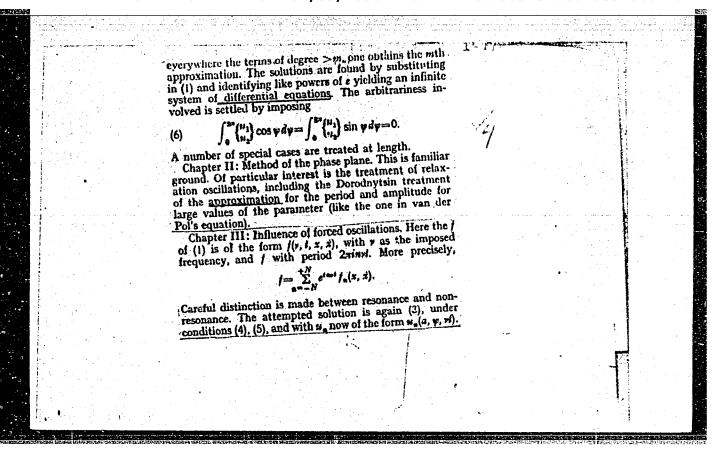
the so-called "functional quadratures" through averaging ordinary Green's functions along quantum functions of the field  $\varphi$ . One reference (1954).

Institution: Mathematical Institute im. V. A. Steklov of the Acad. of Scs. of the USSR

Submitted: ...



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	Let us pass now to a more detailed descriptions.  book consists of a lengthy introduction and five chapters.  book consists of a lengthy introduction and number of ex-	311
	Introduction. One finds here a large number of the amples: physical, mechanical, electrical, illustrating the amples: physical, mechanical, electrical, illustrating the amples: physical, mechanical, electrical, illustrating the amples of non-linear oscillations in various domains.	
	appearance of non-linear oscillations and clear.  The description is always careful and clear.  Chapter I: Self-oscillations in nearly linear systems.	
	the description in nearly timent against	$\mathcal{A}(\mathcal{A})$
	The prototype is	
	The prototype 15  (1) $x + \omega^2 x = \epsilon f(x, x)$ , $\epsilon \ge 0$ and small.	
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	The basic solution	
	(2)	•
	(2) z=a cos y=a cos (ar 17); is used as a starter and one tries to find a solution for (1),	
	with $a$ , $\psi$ variable, of the form  (3) $x=a\cos\psi+\varepsilon u_1(a,\psi)+\varepsilon^2 u_2(a,\psi)+\cdots$ ,	
	(3) $x = a \cos \psi + \epsilon u_1(a, \psi) + \epsilon u_2(a, \psi)$	
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Chapter IV: Averaging method. The system studied is- $\vec{x} = \varepsilon X(t, x)$ 

where x, X are n-vectors and the treatment is by vector-matrix throughout. Let

$$X_{0}(\zeta) = \lim_{T \to +\infty} \frac{1}{T} \int_{0}^{T} X(t, \zeta) dt,$$

and let  $\zeta$  be a solution of  $x = \epsilon X_0(\zeta)$ . Then  $\zeta$  is considered as the first approximation and from it one passes to higher approximations by using suitable Fourier series expansions.

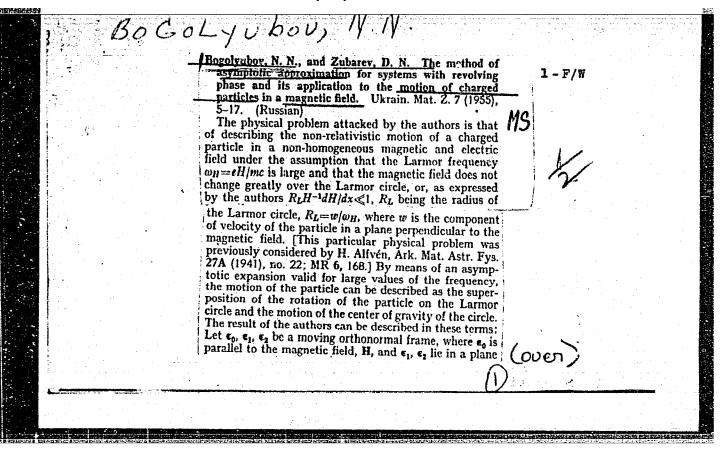
Chapter V: Foundation of the asymptotic methods. In substance it is shown rigorously that under certain very general assumptions, the approximation methods of the previous chapters are justified.

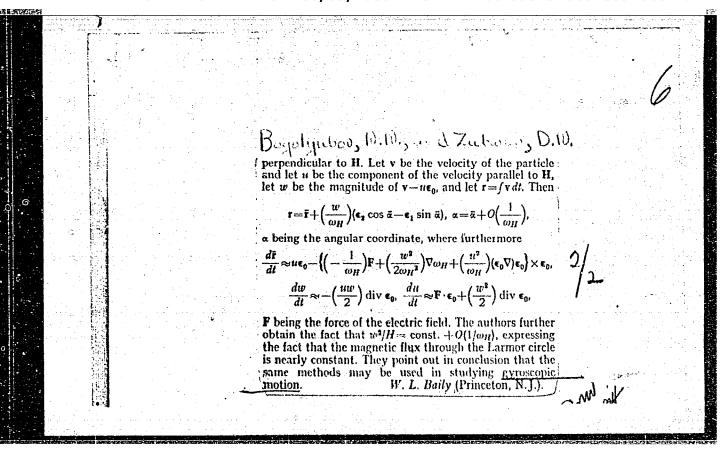
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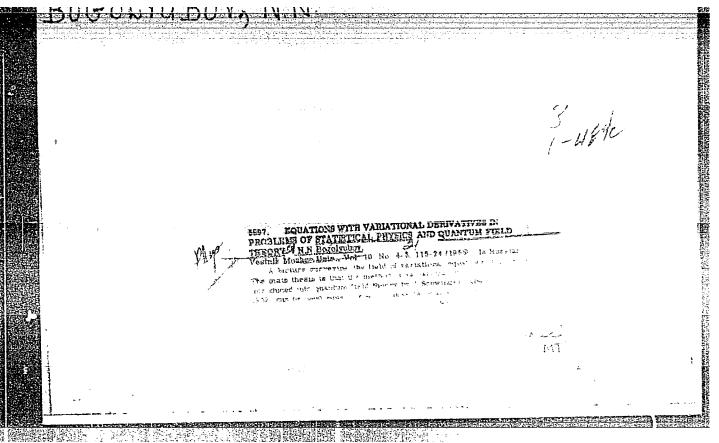
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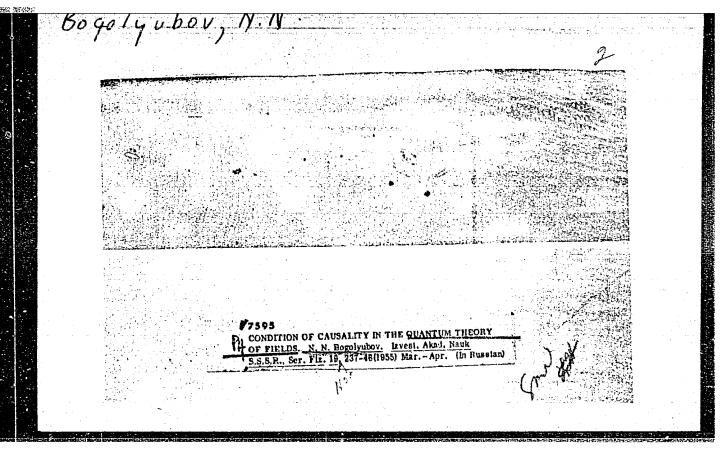
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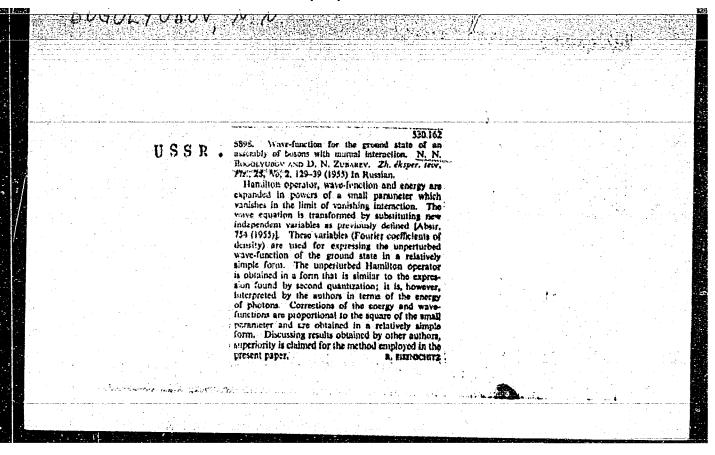
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USSR/Physi Card 1/2	cs - Field theory Pub. 118 - 1/3		
Authors	Bogolyubov, N. N. and Shirtkov, D. V.		
Title	Problems of the quantum theory of a field		
Periodical	Usp. Fiz. nauk 55/2, 149-214, Feb 1955		
	The quantum theory of a field is considered. Due to character of the present day quantum theory, the considered is considered.	mplete description	on of
	a field by this theory meets with considerable difficulties, a study of their nation of this purpose, a method of transformation of the function (used in the ordinary quantum theory) into coperators (used in an advance quantum theory) is problems are considered which involve the determination integrable operators playing a very important role;	ture is suggested so-called field to the so-called presented. Then, tion of singular	ler l
Institution	to overcome these difficulties, a study of their na- for this purpose, a method of transformation of the function (used in the ordinary quantum theory) into "operators" (used in an advance quantum theory) is problems are considered which involve the determinant	ture is suggested so-called field to the so-called presented. Then, tion of singular	ler l
Institution Submitted	to overcome these difficulties, a study of their na- for this purpose, a method of transformation of the function (used in the ordinary quantum theory) into "operators" (used in an advance quantum theory) is problems are considered which involve the determinant	ture is suggested so-called field to the so-called presented. Then, tion of singular	ler l

Card 2/2 Pub. 118 - 1/3

Periodical : Usp. Fiz. nauk 55/2, 149-214. Feb 1955

Abstract

matrixes of dispersion of the theory of interacting fields. Then a method is introduced for the construction of a matrix of dispersion that would be based, not on the Hammiltonian formation, as was done in the ordinary quantum theory, but on the Lagrangenian of an interaction (£(x)) in which physical conditions, relativistic covariation, unitorsion and causality of the matrix elements play the role of a Hammiltonian. Then, a method is presented for determining the so-called "chronological products", i.e., T-products of ordered elements of the matrix of dispersion. This is done with the help of Wick's theorem on the evaluation of the chronological products. In conclusion an application of the Wick theorem to the Feynman rules of evaluation of matrix elements is presented. Twenty-one references: 4 USSR, 10 USA, 3 Brit. and 4 Swiss (1939-1953). Table.

BOG-CLYUBOV, NN.

SUBJECT USSR/MATHEMATICS/Applied mathematics

CARD 1/2

PG - 19

AUTHOR

BOGOLJUBOV N.N., SÍRKOV D.V.

TITLE

Problems of the quantum field theory. II. The removal of diver-

gences from the dispersion matrix.

PERIODICAL

Uspechi fiz. Nauk. 57, 3-92 (1955)

reviewed 5/1956

At first the terms of second and third order in the S-matrix of the quantum electrodynamics are discussed in detail by use of the Feynman diagrams. The convergence of a matrix element depends entirely on the convergence of the expression  $\sum (p)$ . For its regularization a single auxiliary mass M is sufficient. The author investigates the behavior of the regularizated expression for M  $\longrightarrow$   $\infty$ . The general rule for the removal of the divergences consists in the fact that the true causal functions  $\Delta^{C}(x)$  are replaced by regularizated expressions  $\left[\Delta^{C}(x)\right]$  which are obtained by a suitable number of auxiliary masses M. However, in general the limiting process M  $\longrightarrow$   $\infty$  is not even possible in the improper sense. The author introduces a classification of renormability. Then as an example the well-known quantum electrodynamics is treated. The number of different types of diagrams is restricted essentially by several conditions (e.g. loading invariance). With regard to the theorem of Furry finally there exist only four divergent diagrams in the quantum electrodynamics. The S-matrix is discussed in detail and it is shown

Translation D419421-6.49

Uspechi fiz. Nauk. <u>57.</u> 3-92 (1955)

CARD 2/2 PG - 19

- that the introduction of five terms of compensation in the Lagrange function of the interaction leads to the renormalization of mass and loading of the free fermion.

BOGOLYUBOV, N.N.

SUBJECT USSR/MATHEMATICS/Applied mathematics CARD 1/2 PG-546/547

AUTHOR BOGOLJUBOV N.N., PARASJUK O.S.

TITLE On the theory of multiplications of singular causal functions.

On a formalism of subtraction for the multiplication of

singular causal functions.

PERIODICAL Doklady Akad. Nauk 100, 25-28 (1955)

Doklady Akad. Nauk 100, 429-432 (1955)

reviewed 1/1957

As a continuation of earlier papers of the authors (Doklady Akad.Nauk 81, nos. 5 and 6 (1951), ibid. 82, no. 2 (1952)), in the first paper a detailed treatment of the singular expressions appearing in the theory of perturbation is given. In order to give a mathematically exact treatment, the authors "regularize" the used "functions of propagation" and write e.g.

reg 
$$\Delta^{c}(x) = \frac{1}{(2\pi)^4} \int e^{ikx} \int_{0}^{\infty} \left[1 + \sum_{j=1}^{\infty} e^{-i\alpha (k_j^2 - m^2)}\right] e^{i\alpha (k_j^2 - m^2 + i\xi)} dk d\alpha$$

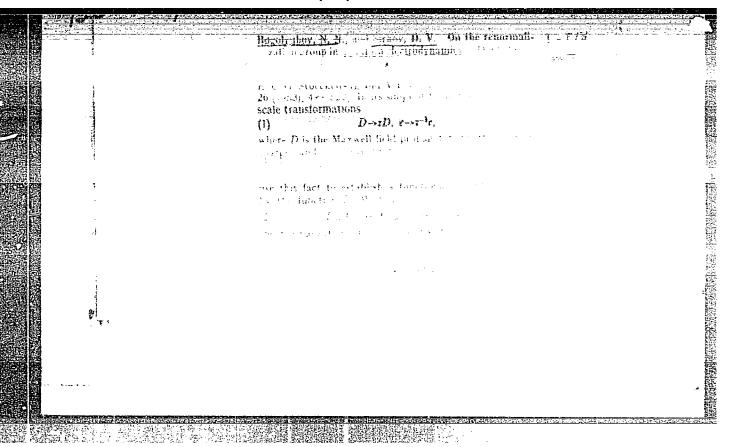
where the auxiliary masses  $H_j$  and the constants  $c_j$  satisfy (h+1) conditions of the kind  $\sum M_j^{21} c_j = 0$ ; 1 =0,1,...h, (In the usual applications we have h=1).

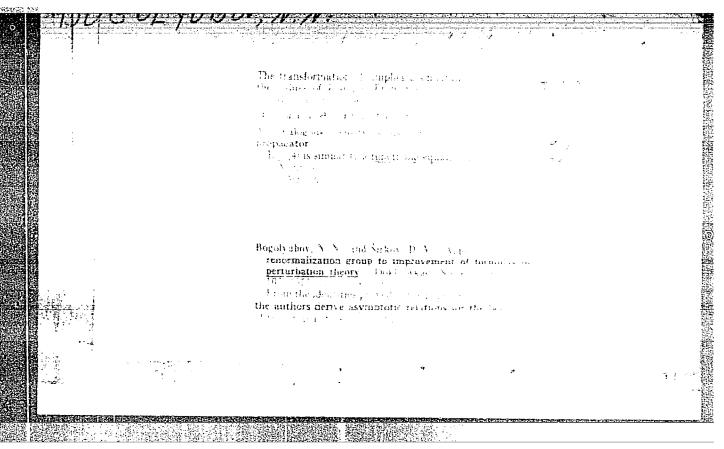
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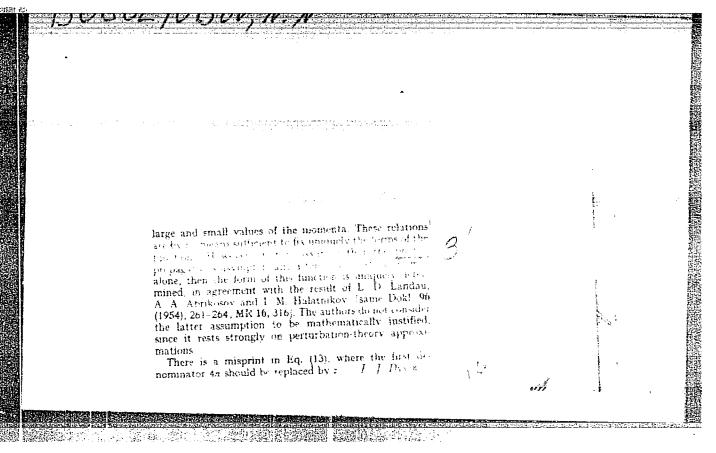
CARD 2/2 PG - 546/547

On this basis then a strong formulation of the treatment of divergent integrals in the theory of perturbation is given. Renormalizations are considered too.— In the second paper a general form for the result of the first paper is given. The established equations are proved by induction from n to n+1.

INSTITUTION: Acad. of Scs. of the USSR, and The V. A. Sfeklov Mathematical Institute, Acad. of Scs. of the UkrSSR, Institute of Mathematics.







BOGOLYUBOV, N.N., akademik; SHIRKOV, D.V.

THE PROPERTY WAS A STREET

Application of renormalized groups to the improvement of the perturbation theory. Dokl. AN SSSR 103 no.3:391-394 J1'55.

(MLRA 8:11)

1. Matematicheskiy institut imeni V.A.Steklova Akademii nauk SSSR (Perturbation) (Quantum theory)

BOGOLYUBOV, N.W., akademik; SHIRKOV, D.V.

A Lee-type model in quantum electrodynamics. Dokl. AN SSSR 105 no.4:685-688 D 155. (MLRA 9:3)

1. Matematicheskiy institut imeni V.A. Steklova Akademii nauk SSSR.

(Quantum theory)

BOGOLYUBOV, N. N., and TYABLIKOV, S. V. (Moscow)

"Approximative secondary quantization methods in the quantum theory of magnetizm," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

BOGOLYUBOV, N.N.

TAVKHELIDZE, A.N.; BOGOLYUBOV, N.N., akademik, nauchnyy rukovoditel'.

[Field theory methods in problems with a fixed nucleon source; abstract of a dissertation offered for the degree of candidate of physical and mathematical sciences] Metody teorii polia v sadachakh s fiksirovannym nuklonnym istochnikom; avtoreferat dissertatsii, predstavlennoi na soiskanie uchenoi stepeni kandidata fixikomatematicheskikh nauk. Moskva, Akad.nauk SSSR, 1956. 5 p.

(MIRA 10:11)

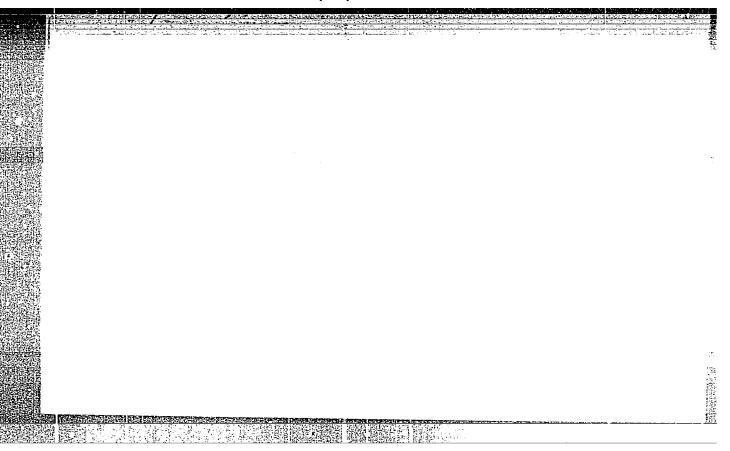
(Nucleons)

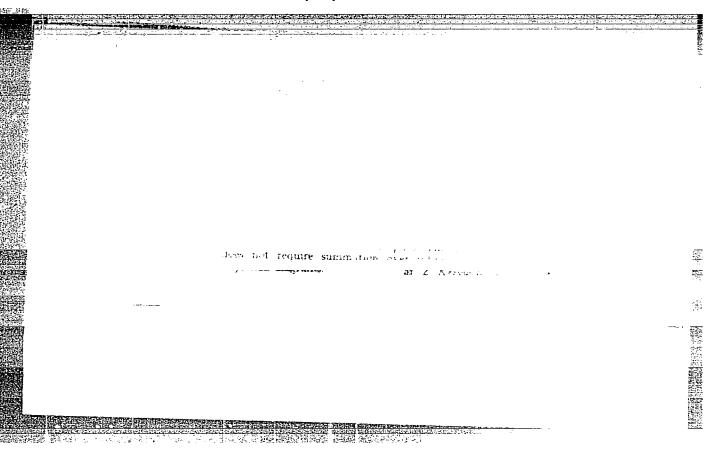
FRENKEL', Ya.I.; SEMENOV, N.N., akademik, redaktor; SOKOVOV, A.A., doktor fisiko-matematicheskikh nauk, redaktor; BOGOLYDBOV, H.M., akademik, redaktor; TANM, I.Ye., akademik, otvetstvennyy redaktor; AFSEL'N, A.I., doktor fisiko-matematicheskikh nauk, redaktor; BIOKHINTSEV, D.I., doktor fisiko-matematicheskikh nauk, redaktor; KONTOROVA, T.A., kandidat fisiko-matematicheskikh nauk, redaktor; GOLANT, V.Ye., redaktor izdatel'stva; SHIRNOVA, A.V., tekhnicheskiy redaktor

[Selected works] Sobranie isbrannykh trudov. Moskva, Izd-vo Akademii nauk SSSR. Vol.1. [Electrodynamics; general theory of electricity] Electrodinamika; obshchaia teoriia elektrichestva. 1956. 370 p.

(MLRA 9:11)

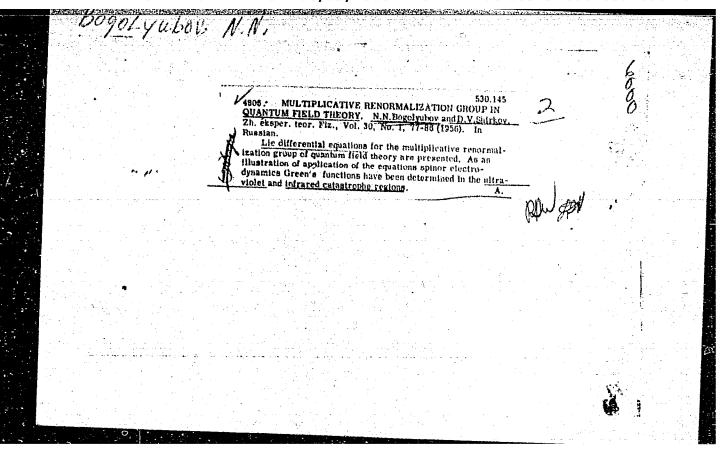
1. Chlen korrespondent AN SSSR (for Frenkel')
(Electrodynamics)





BOGOLYUBOV, N.N.; PARASYUK, O.S.

Subtraction formalism associated with the multiplication of causality functions. Izv. AN SSSR. Ser. mat. 20 no.5:585-610 S-0 '56. (MIRA 11:6)



BOGOLYUBOY, N.N. BOGOLYUBOY, N.N.

SUBJECT AUTHOR

USSR/MATHEMATICS/Theory of functions

CARD 1/2 PG - 678

TITLE

BOGOLJUBOV N.N., PARASJUK O.S.

On the analytic continuation of generalized functions. PERIODICAL Doklady Akad. Nauk 109, 717-719 (1956)

reviewed 4/1957

For complex-valued functions  $\bigoplus$  (E) of a real argument E,  $-\infty < E < \infty$  of  $\mathcal{L}^{2}(-\infty,+\infty)$  there holds the theorem that these functions are continuable into the upper halfplane if and only if their Fourier transform  $\phi(t)$  vanishes for t < 0. The development of the modern quantum theory, its spacius connection with the analytic continuation induce the authors to transfer the above mentioned theorem to generalized functions. Generalized functions f(E) are linear functionals on the spaces C(q,r,1) of the function  $\varphi(E)$  which have

 $E^{s} \frac{d^{p} \varphi(E)}{dE^{p}}$  (s=0,1,...r; p=0,1,...q) are q-derivatives, where all products

bounded (compare Bogoljubov and Sirokov, Uspechi fiz. Nauk 5, No.2, 141 (1955)) and Parasjuk, Doklady Akad. Nauk 100, No.4, (1955)). If f(E) is a functional on C(q,r,1), then f(E) is called integrable on C(q,r,1). In R the generalized function f(t) equals zero if the functional determined by it equals zero on those functions which annihilate themselves outside of R. Definition: a generalized complex-valued function  $\widetilde{f}(E)$  is called analytically

Doklady Akad. Nauk 109, 717-719 (1956)

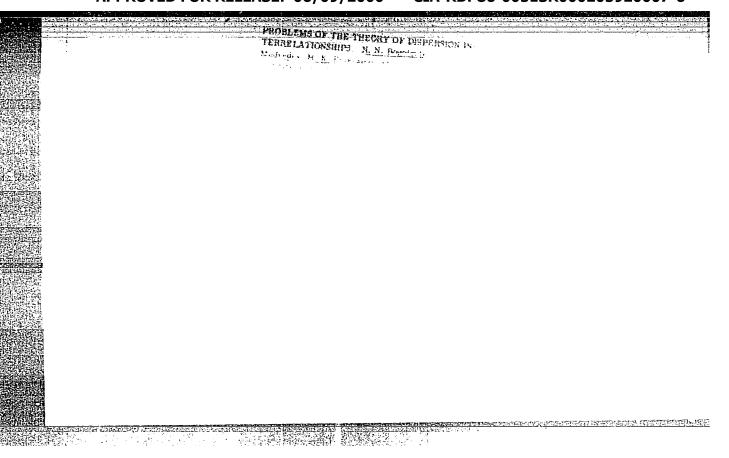
CARD 2/2 PG - 678

continuable into the above halfplane of the plane  $z = E+i\Gamma$  if there exists an analytic function  $f(E+i\Gamma)$  such that 1)  $f(E+i\Gamma)$  for  $\Gamma \rightarrow 0$  tends to f(E) in the sense of the weak convergence and 2) there holds the estimation

$$|\widetilde{f}(E+i\Gamma)| \leq A_0(\delta)|E|^m + A_1(\delta)|E|^{m-1} + \dots + A_n(\delta),$$

where m is a positive integer and the A<sub>i</sub> are real constants depending on  $\delta$  only. Theorem: In order that the generalized complex-valued function f(E) is analytically continuable into the upper halfplane it is necessary and sufficient that the Fourier transform f(t) of f(E) vanishes for t < 0.

INSTITUTION: Math.Inst.Acad.Sci. USSR.



Call Nr: QC 174.5.B6

Introduction to the Theory of Quantum Fields (Cont.)

COVERAGE:

The authors have attempted to give a systematic presentation of the development of the theory of quantum fields, from its basic principles to its latest achievements, with emphasis on mathematical accuracy and on reporting the latest, most promising trends. The authors express their appreciation to the staffs of the Department of Theoretical Physics, Institute of Mathematics im. V. A. Steklov, USSR Academy of Sciences, and of the Department of Statistical Physics and Mechanics, Moscow State University im. M. V. Lomonosov, in particular to B. V. Medvedev, for help in writing the book. There are 107 references, 37 of which are Russian, 1 Polish, 3 French, 1 German, 48 American, 17 Italian, Swiss, Dutch.

Card 2/34

BOGOLY4BCV, N. A. 48-6-13/23 USSR/Physics of Magnetic Phenomena SUDJECT:

Bogolyubov, N.N. and Tyablikov, S.V. AUTHORS:

Approximate Methods of Secondary Quantization in the Quantum Theory of Magnetism (Priblizhennyye metody vtorichnogo kvanto-TITLE:

vaniya v kvantovoy teorii magnetizma)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1957, Vol 21,

#6, pp 849-853 (USSR)

The problem of a rigorous calculation of the energetic spectrum for ferromagnetic materials is extremely difficult, and there-ABSTRACT:

fore, approximate methods were devised for its treatment.

These methods enter into two stages of calculations:

1. The constructing of a simplified "model" Hamiltonian which conveys characteristic peculiarities of a studied dynamic system; 2. The formulation of an approximate method for such a simpli-

fied Hamiltonian.

The starting point in constructing the simplified Hamiltonian is a rigorous Hamiltonian of the system in secondary quantization presentation. However, only a part of the atomic wave functions is accounted in actual calculations, following the ideas

Card 1/3

48-6-13/23

TITLE:

Approximate Methods of Secondary Quantization in the Guantum Theory of Magnetism (Priblizhennyye metody vtorichnogo kvanto-vaniya v kvantovoy teorii magnetizma)

of Ritz.

Then an approximate method is applied to this simplified Hamiltonian. The resulting form coincides with the form of the second variation in the quasi-classical treatment.

Since in this approximation the Hamiltonian is a quadratic form of Bose-operators, its diagonalization does not present any difficulties.

This method of calculating the energetic spectrum of weaklyexcited states was applied by the authors to the theory of ferromagnetic materials and led to the known results in the Bloch
theory of spin waves. When spin-spin and spin-orbital interaction terms are included into the Hamiltonian, it is possible
to calculate the temperature— and field intensity-dependence
of the magnetic anisotropy (4, 5) and the magnetostriction (6).
The methods developed were also applied to the theory of antiferromagnetism (2).

Card 2/3

There are 11 references, 10 of which are Russian.

48-6-13/23

TITLE:

Approximate Methods of Secondary Quantization in the Quantum Theory of Magnetism (Priblishennyye metody vtorichnogo kvantovaniya v kvantovoy teorii magnetisma)

ASSOCIATION: Physical Department of the Moskva State University imeni Lomonosov.

PRESENTED BY:

SUBMITTED:

No date indicated.

AVAILABLE: At the Library of Congress.

Card 3/3

BOGOLYUBOV, N.N.; SANOCHKIN, Yu.B.

Ludwig Boltzmann. Usp.fiz.nauk 61 no.1:7-15 Ja '57. (KLRA 10:2)

(Boltzmann, Ludwig, 1844-1906)

AUTHOR

BOGOLYUBOV N.N., Member of the Academy, SilIRKOV D.V. PA - 3134

TITLE

Dispersion Relations For the COMPTON Scattering On Nucleons

(Dispersionnyye sootnosheniya dlya komptoncyskogo rasseyaniya na nuklc-

nakh -Russian)

Received 6/1957

PERIODICAL

Doklady Akademii Nauk 353R, 1957, Vol 113, Nr 3, pp 529-532 (U.S.S.R.)

Reviewed 7/1957

ABSTRACT

For the analysis of the amplitude f of COMPTON scattering the authors confine themselves to the examination of the main term proportional tem. They therefore put e = 0 in the expressions for the corresponding variation derivations, on waich occasion only strong interactions are taken into account. The dispersion relations for the scattering of photons by nucleons can be determined by the same method by which N.N.BOGOLYUBOV deter... mined the dispersion relations for the scattering of pions by nucleons. At first an ansatz for the amplitude of COMPTON scattering is written down. A function occurring in this ansatz is the impulse image of the "causal" matrix element. Besides, "retarded" and "advanced" matrix elements are introduced. For the imaginary case  $\lambda^2 = E^2 - p^2 - T$ ,  $T < -p^2$ , functions S + Tcan be defined which are analytical (with the exception of intersection lines and poles on the real axis) within the entire plane of the complex variables E. The intersection lines and poles are determined according to a complete function system by development of the HAMILTONIAN of the mesonand the nucleon field. The emplitude of COMPTON scattering in infinity is assumed to have a pole of, at the most, first order.

Card 1/2

Dispersion Relations For the COMPTON Scattering On Nucleons. PA - 3134 Also the exclusion of the unobservable domain of the negative energies is discussed in mort. The dispersion relations obtained herehave the following important properties: Not only on the occasion of scattering in a forward direction, but also for a finite interval of recoil impulse these dispersion relations contain no unobservable domain of energy. (1 illustration)

ASSOCIATION United Institute for Nuclear Research

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29.3.1956

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Card 2/2

Bogolyubov, N.N.

20-5-11/54

AUTHORS:

Bogolyubov, N. H., A.

Lotunov, A. A.

TITLE:

Dispersion Relations in Cases of Weak Interaction (Dispersionnyye sootnosheniya v sluchayakh slabogo

vzaimodeystviya).

PERIODICAL:

Doklady Akademii Nauk SSSR, 1957, Vol. 115, Nr 5,

pp. 891-893 (USSR)

ABSTRACT:

At present dispersion relations meet with considerable interest because in this way the fact of the existence of an elementary length can be determined experimentally. It is of interest to analyze what these relations tell us in the case of a weak interaction. As an example the

authors investigate the reaction

μ + p → n + Ψ

in which, besides a weak interaction, there exists a strong interaction between nucleon and the meson field. In the theory of the dispersion relations the amplitude of the process is split up into a hermitean and an antihermitean part. In those systems of coordination in which the sum

CARD 1/3

Dispersion Relations in Cases of Weak Interaction

20-5-11/54

of the momenta of the nucleon before and after the reaction is equal to zero, the hermitean part D is equal to a certain integral of the antihermitean part A plus any polynomial  $P_n(E)$  above the energy E of the impinging particle. The antihermitean part of the amplitude is expressed by the product of the meson current and the neutrino current. Because of the smallness of the constant of the weak interaction only those terms must be taken into account which contain the coupling constant in first approximation. This product is here at least small of second order and therefore the antihermitic part in the approximation investigated here is equal to zero. Accordingly, the dispersion relation takes on an especially simple form:  $D(E) = P_n(E)$ . Next, the matrix element of the process  $\mu + p \rightarrow n + V$  is written down and transformed. The unknown functions of the amplitude of the process determined by strong interaction depend only upon the transmission of the momentum to the nucleons. By

CARD 2/3

Dispersion Relations in Cases of Weak Interaction

20-5-11/54

studying the dependence of these functions of the transmission of the momentum to the nucleon, the "mesonneutrino structure" of the nucleon can be determined. The effective measurements of the "meson-neutrino structure" are apparently the same as the "meson structure". The results obtained here are well suited for the  $\beta$ -decay and for those processes of decay of hyperons and K-mesons, in which, together with particles which are in strong interaction, also  $\mu$ , e- and V - particles participate. From the point of view of the verification of the causation principle the study of angular- and energy distribution of the electrons and myons in the processes of decay of the hyperons and K-mesons is of special interest. There are 1 figure, and 2 Slavic references.

ASSOCIATION: United Institute for Nuclear Research (Ob)yedinennyy

institut yadernykh issledovaniy).

SUBMITTED:

May 22, 1957

AVAILABLE:

Library of Congress

3/3 CARD

AUTHORS:

Bogolyubov, N.N., Academician, Zubarev, D.N., 20-117-5-16/54 Tserkovnikov, Yu. A.

TITLE: PERIODICAL: ABSTRACT:

On the Theory of Phase Transition (K teorii fazovogo, perekhoda). Doklady AM USSR, 1957, Vol. 117, Nr 5, pp. 788-791 (USSR) The theory of supraconductivity may be conveniently developed by starting from from the summing form  $H = H_0 + H_{int}$ ,  $H_0 = \sum_{k,s} (E(k) - \lambda)a_{k,s}^+ a_{k,s}^+$ ,  $a_{-k,-1/2}^+ a_{k,1/2}^+ a_{k,-1/2}^+$ . The summing

up process in  $H_{int}$  is extended only to the momenta, k,k', belonging to the energy level  $E_F - \omega < E(k) < E_F + \omega$ . The author show, that in the case of this Hamiltonian it is possible to construct the thermodynamic potential  $\Psi = F - \lambda N = -\theta \ln Sp \ e^{-H/Q}$  at  $V \rightarrow$ in an asymptotically exact manner. Moreover, a computation of this kind is also possible for the more general expression H = \( \sum\_{\text{op}} \)

 $(E(k)-\lambda)a_{k,8}^{+}-\frac{1}{v}\sum_{(k,k')}J(k,k')a_{-k,1/2}^{+}a_{k,1/2}a_{k,1/2}a_{-k,-1/2}$ . Because of the

circumstance, that the theory of phase transition furnishes examples which can be solved only incorrectly, the authors considered it appropriate to develop a method for the computation of the ther-

Card 1/2

On the Theory of Phase Transition.

20-117-5-16/54

modynamical functions of the Hamiltonian given just above, even the more, as applications to the theory of supraconductivity may emerge here. The authors here introduce the canonical transformation  $\alpha_{k,1/2} = u_k \alpha_{k,0} + v_k \alpha_{k,1}^+, \alpha_{-k,-1/2} = u_k \alpha_{k,1} - v_k \alpha_{k,0}^+, 0, u_k$ 

v<sub>k</sub> denoting real functions, which are connected by the relation  $u_k^2 + v_k^2 = 1$ . The Hamiltonian thus transformed is given explicitly. Into the same shape is then transformed the statistical form of perturbation theory. The process of computation is followed step by step. The phase transition takes place at that temperature, at which one of the equation given here posesses a nontrivial solution. There are 3 references, 2 of which are Slavic.

SUBMITTED:

November 13, 1957

Card 2/2

Name : BOGOLYUBOV, N. N.

Title : Academician

Remarks: In an article entitled "The Theory of Superconductivity", N. N. Bogolyubov gives a brief synopsis of his work in evolving this theory. For this work N. N. Bogolyubov was awarded the Lomonosov Prize, First Class, by the Moskva State University. N. N. Bogolyubov refers to the

following people as colleagues: D. N. Zubarev, V. V. Tolmachev, S. V. Tyablikov, Yu. A. Tserkovnikov.

Source: N: Pravda, No. 365, 31 December 1957, p. 2, c. 1-3

BOGOLYUBOV, N. N.

"Many-Body Problem Studies and Their Application in the Theory of Nuclear Matter."

paper to be presented at 2nd UN Intl. Comf. on the peaceful uses of Atomic Energy, Geneva, 1 - 13 Sept 58.

BOGOLYUBOV, N. N. and VLADIMIROV, V. S.

"On Analytic Continuation of Generalized Functions."

paper submitted at International Congress Mathematicians Edinburgh, 14 - 21
Aug 58.

BOGOLYUBOV, Nikolay Hiolayevich; TOLLMACHEV, Vladimir Veniaminovich; SHIRKOV, Dmitriy Vasil yevich; GUROV, K.P., red.izd-va; POLENOVA, T.P., tekhn.red.

[New method in the theory of superconductivity] Novyi metod v teorii sverkhprovodimosti. Moskva, Izd-vo Akad.nauk SSSR, 1958: 127 p.
(Superconductivity) (MIRA 11:6)

16,24(5)

PHASE I BOOK EXPLOITATION

SOV/1217

Bogolyubov, Nikolay Nikolayevich; Medvedev, Boris Valentinovich; and Polivanov, Mikhail Konstantinovich

Voprosy teorii dispersionnykh sootnosheniy (Problems of the Theory of Dispersion Relations) Moscow, Fizmatgiz, 1958. 202 p. (Series: Sovremennyye problemy matematiki) 6,500 copies printed.

Ed.: Shirkov, D.V.; Tech. Ed.: Tumarkina, N.A.

PURPOSE: This book is intended for persons working in the quantum field theory who are interested in the method of dispersion relations and its mathematical structure.

COVERAGE: The book contains a detailed presentation of the mathematical structure of the method of dispersion relations. The main problems studied are the method of determining dispersion relations with the exactness needed in ordinary physics work, physical assumptions necessary for obtaining the dispersion relations, and to what degree dispersion relations are con-

Card 1/3

Problems of the Theory (Cont.)

SOV/1217

nected with recent quantum field theory. The book is dedicated to Vladimir Zalmanovich Blank (deceased). The authors thank the staff members of the Department of Theoretical Physics of the Matematicheskiy institut imeni V.A. Steklova (Mathematics Institute imeni V.A. Steklov) of the Academy of Sciences, USSR, and those of the Laboratory of Theoretical Physics of the Ob yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research), for their remarks and suggestions. Special gratitude is expressed to the Editor of the book, D.V. Shirkov, and to V.S. Vladimirov, for their cooperation in discussing the mathematical problems presented. There are 35 references, of which 12 are Soviet, 20 English, and 3 German.

#### TABLE OF CONTENTS:

1. Introduction

7

2. Basic Physical Assumptions

19

Card 2/3

Problems of the Theory (	Cont.) SOV/1217	
3. Relationship Between	Radiation Operators	33
4. Vacuum Means of Base	Radiation Operators of the Second Order	44
5. Vacuum Means of Fermi Order	i Radiation Operators of the Second	61
6. Construction of Dispe	ersion Relations	71
7. Study of Analytic Pro	operties of the ST Function	100
8. Physical Dispersion F	Relations	·
Appendix A. Analyticity T	Theorems	132
Appendix B. Calculation of	of the Single Nucleon Construction	191
References		201
AVAILABLE: Library of Co	ongress LK/lsb	
Card 3/3	3-24-59	

PHASE I BOOK EXPLOITATION

957

- Bogolyubov, Nikolay Nikolayevich and Mitropol'skiy, Yuriy Alekseyevich
- Asimptoticheskiye metody v teorii nelineynykh kolebaniy (Asymptotic Methods in Nonlinear Oscillation Theory) 2d., rev. and enl. Moscow, Fizmatgiz, 1958. 408 p. 7,000 copies printed.
- Ed.: Zhabotinskiy, Ye. Ye.; Tech. Ed.: Kolesnikova, A.P.
- PURPOSE: This book deals with the solution of problems of the theory of nonlinear oscillations by approximate asymptotic methods, and is intended for engineers and scientific workers.
- COVERAGE: The book consists of an introduction and six chapters. Chapter I deals with the natural oscillations in systems close to linear with one degree of freedom. In Chapter II the basic concepts of the phase plane and of free oscillations in systems

Card 1/7

Asymptotic Methods in Nonlinear Oscillation Theory 957

of relaxation type are studied and the large parameter method of A.A. Dorodnitsyn is presented. In Chapter III the authors investigate the effect of external periodic forces on oscillation systems. In Chapter IV single-frequency oscillations in systems with many degrees of freedom are analyzed and the method of slowly changing parameters, which now is extensively used in practice, is presented. In Chapter 5 the methods of averaging and their application to systems with many degrees of freedom are studied. Chapter 6 is intended for mathematicians interested in the theory of differential equations with small parameters. The foundations of asymptotic methods are considered and series of theorems on the existence and stability of periodic and almostperiodic solutions are established. In the introduction, Soviet personalities mentioned include A.M. Efros, A.M. Danilevskiy, N.M. Krylov, N.N. Bogolyubov and A.I. Lur'ye in connection with the development of symbolic methods of solution of differential equations. L.I. Mandel'shtam, N.D. Papaleksi, A.A. Andronov and

Card 2/7

Asymptotic Methods in Nonlinear Oscillation Theory 957

A.A. Vitt are mentioned in connection with the application of Lyapunov-Poincaré methods to systematic analysis of nonlinear oscillations, and N.N. Krylev, N.N.Bogolyubov and Yu. A. Mitripol'skiy in connection with the asymptotic methods presented in this book. In the preface to the second edition the authors thank graduate student O.B. Lykov for his help in preparing the manuscript. There are 49 references, of which 49 are Soviet (including 5 translations), 3 English, 3 French, 1 German and 1 Italian.

#### TABLE OF CONTENTS:

Preface to Second Edition	5
Preface to First Edition	6
Introduction	7
Card 3/7	

h T.	Natural Oscillations in Systems Close to Linear	36 36 49 60 68
1	Constitution of Meaning of the potential	70
2.	Conservative systems Close to linear	60
٦.	The case of nonlinear friction	68
4.	······································	76
5.	Gtationary amplitudes and their stability	76 86
23456		•
7•	Equivalent linearization of nonlinear oscillation	93
	systems with slowly changing	-
8.	Nonlinear oscillation systems with slowly changing	107
	parameters	_
	m Mana mana Mathod	116
	. The Phase-plane Method Trajectories in the phase plane. Singular points	
9•	[singularities]	116
	Liénard method	133
10.	n-l	144
		- 1-0
12.	The method of Kaka Box others	148
	equation	

Asymptotic Methods in Nonlinear Oscillation Theory 957	
Ch. III. The Effect of External Periodic Forces 13. Asymptotic expansions in the "nonresonance" case	155 155 170
15. Effect of a sinusoidal tharmonic, force on a nonzerous	185
vibrator 16. Effect of a sinusoidal [harmonic] force on a nonlinear system with a characteristic composed of straight-line segments [broken line characteristics]	198 209
.17. Parametrical resonance 18. Effect of periodic forces on a relaxational system	221
18. Effect of periodic forces on nonlinear systems 19. Effect of nonperiodic forces on nonlinear systems with slowly changing parameters	232
Ch. IV. Single-frequency Oscillations in Nonlinear Systems With Many Degrees of Freedom	247
20. Natural single-frequency oscillations in systems with	247
many degrees of freedom  21. Natural single-frequency oscillations in systems with many degrees of freedom given by a system of second- order differential equations	259
Card 5/7	

Asympto	tic Methods in Nonlinear Oscillation Theory 957	
22. 23.	oscillations in systems with many degrees of freedom 23. The study of single-frequency oscillations in nonline	
	systems with many degrees of freedom in the presence of slowly changing parameters	281
Ch. V.	Method of Averaging Equations of the first and higher approximations in the	297
25.	method of averaging	
ch. VI. 26. 27. 28.	Foundations of Asymptotic Methods Substantiation of the method of averaging Transformation of the fundamental system of equations Certain properties of solutions of transformed equations in the neighborhood of equilibrium points and closed orbits [regions]	327 327 332
Card 6/7	orbits (regions)	355

Asymptotic Methods of Nonlinear Oscillation Theory 957

29. Correspondence between exact and approximate solutions of the fundamental equation to the dustants.

of the fundamental equation in the infinite interval 30. Periodic and almost periodic solutions

379 386

References

407

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LK/ksv 12-19-58

Card 7/7

FRENKEL', Yakov Il'ich, Hecessed 1945]; SEMENOV, N.N., akad.etv.red; SCKOLOV, A.A.doktor fiz.-mat. nauk, red.; BOOOLYUBOV, N.N., akad., red.; TAAM, I.Te., akad., red.; ANSEL'M, A.I., doktor fiz.-mat. nauk, red.; BLOKHINTSEV, D.I., doktor fiz.-mat. nauk, red.; KONTOROVA, T.A., kand. fiz.-mat. nauk, red. izd-va,; SMIRNOVA, A.V., tekhn. red.

[Selected works] Sobranie izbrannykh trudov. Moskva, Izd-vo Akad. nauk SSSR. Vol. 2. [Scientific articles] Nauchnye stat'i. 1958. 600 p. (MIRA 11:11)

1. Chlen-korrespondent AN SSSR (for Frenkel').
(Physics)

Theory of the superconducting state. Nauch. dokl. vys. skoly;
fiz.-mat. nauki no.1:3-11 '58. (MIRA 12:3)

1. Matematicheskiy institut im. V.A. Steklova AN SSSR.

(Superconductivity)

16(1), 24(5)

AUTHORS: Bogolyubov, N.N., Medvedev, B.V., and SOV/155-58-2-31/47

Polivanov, M.K.

TITLE: On the Question on the Indefinite Metric in the Quantum Field Theory (K voprosu ob indefinitivnoy metrike v kvantovoy teorii

polya)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki,

1958, Nr 2, pp 137-142 (USSR)

ABSTRACT: The authors join the well-known publication of Heisenberg [Ref 2]

in which the "physical" states with a positive norm are completed by "unphysical" states with a negative norm; in the Hilbert space of the state amplitudes this can be reached by the introduction of an indefinite metric. The authors investigate the possibilities resulting in the theory by the introduction of an indefinite metric. According to Heisenberg, the field is represented as a sum of a

According to Heisenberg, the field is represented as a sum of a physical field  $\psi(x)$  and a number of fictive fields  $\psi_n(x)$ . The corresponding state space H then is divided into a subspace H,

containing only the physical particles of the type  $\Psi$ , and into its orthogonal complement  $H_2$ :  $H = H_1 + H_2$ . The arising specific

difficulty (appearance of "unphysical" states in the asymptotic

Card 1/2

On the Question on the Indefinite Metric in the Quantum SOV/155-58-2-31/47 Field Theory

expressions of observed magnitudes) demands certain restrictions. Proposals referring to this have already been given by Gupta and Heisenberg. The authors investigate a third possibility: They assume that every amplitude consists of a physical and a non-physical part, where the non-physical part F is determined uniquely by the physical part  $\varphi$ . A physical dispersion matrix S is defined by  $\varphi$  = S  $\varphi$  where  $\varphi$  is the state of  $\varphi$  for t =  $\pm \infty$ , and it is shown that under certain additional postulates S is unitary and the states of H form a complete system for it so that no transitions from H into H are caused by it. Particularly simple states result in the case of the matrix K of Wigner. The proposed method is discussed by an example of the classical mechanics. There are 4 references, 1 of which is Soviet, and 3 American.

ASSOCIATION: Matematicheskiy institut imeni V.A. Steklova (Mathematical Institute imeni V.A. Steklov)
SUBMITTED: March 5, 1958

Card 2/2

16(1) sov/155-58-3-6/37 Bogolyubov, N.N., and Vladimirov, V.S. · AUTHORS: \_ A Theorem: of the Analytic Continuation of Generalized Functions (Odna teorema ob analiticheskom prodolzhenii obobshchennykh TITLE: funktsiy) PERIODICAL: Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki, 1958, Nr 3, pp 26-35 (USSR) Let  $x, \zeta, p...$  be the points  $(x_0, x_1, ..., x_n), (\zeta_0, \zeta_1, ..., \zeta_n)$ , while ABSTRACT:  $\vec{x} = (x_1, \dots, x_n)$ , so that  $x = (x_0, \vec{x}) \dots$ . Let  $x = x_0 = x_0$  $x^2 = x_0^2 - \frac{1}{2}$  etc. Let S be a space of functions differentiable at infinity which together with their derivatives vanish in infinity quicker than  $(x_0^2 - x^2)^{-N}$ , N>0. A linear continuous functional over S is understood as a generalized function. Theorem: Let the generalized function  $F_{\bf r}(x)$ ,  $F_{\bf a}(x)$  vanish for  $x_0 < 0$  and  $x^2 < 0$  respectively or for  $x_0 > 0$  and  $x^2 < 0$  respectively. Let their Fourier transforms Card 1/3

A Theorem of the Analytic Continuation

sov/155-58-3-6/37

of Generalized Functions

$$\widetilde{F}_{j}(p) = \int F_{j}(x)e^{ipx}dx$$
,  $dx = dx_{0} dx_{1}...dx_{n}$ ,  $j = r,a$ 

be identical in

(1)  $p^2 < m$ .

Then there exists an integral N>0 so that in (1) it holds:

$$\widetilde{F}_{\mathbf{r}}(\mathbf{p}) = \widetilde{F}_{\mathbf{a}}(\mathbf{p}) = \sum_{k=0}^{N} P_{k}(\mathbf{p}) \, \phi_{k}(\mathbf{p}^{2}),$$

where  $P_k(p)$  are polynomials and the functions  $\varphi_k(\xi)$  can be continued analytically in the whole complex w-plane with the exception of the cut

(2) Im w = 0, Re  $w \geqslant m$ . Besides the  $\phi_k(w)$  in all points w being distant more than  $\delta > 0$ 

Card 2/3

A Theorem of the Analytic Continuation of Generalized Functions

SOV/155-58-3-6/37

from the cut (2) are bounded by a polynomial the degree of which does not depend on  $\delta$ .

The author mentions S.L.Sobolev, and K.I.Babenko.

There are 11 references, 4 of which are Soviet, 2 French,

1 Italian, 2 American, and 2 Swedish.

ASSOCIATION: Matematicheskiy institut imeni V.A. Steklova AN SSSR (Mathematical Institute iemni V.A. Steklov, AS USSR)

SUBMITTED: April 16, 1958

Card 3/3

Bogolyubov, N. N. Academician 30-58-4-3/44 AUTHOR: Problems of the Superfluidity of Bose-and Fermi-Systems (Vo-TITLE: prosy teorii sverkhtekuchesti Boze- i Ferni-sistem). Nr 4, pp. 25 - 29 Vestnik Akademii Nauk SSSR, 1958, PERIODICAL: (USSR) These problems require the use of methods which have been ABSTRACT: worked out for the solution of the multiple-body-problem. Though the superfluidity of helium was discovered much later than superconductivity, the first mentioned effect could be cleared much emier because of works of the author. (Ref 1). It is commonly known that in the case of an ideal Bose-gas at sufficiently low temperatures a condensate falls out; at a finite relative number of particles the impulses are equal to zero. At zero-temperature all particles are in this state. But such a state does not have the qualities of superfluidity, If there is a repelling reciprocal effect, though weak, the condensate forms a combined collective. In the case of its movements as a whole the slowing down of single particles and their precipitation from the condensate is, with regard to energy, unprofitable if only the velocity of motion is satisfactory low. This way the quality of the superfluidity becomes apparent. Card 1/3

Problems of the Superfluidity of Bose- and Fermi-Systems 30-58-4-3/44

To come to this result it was necessary to investigate the lower energetic spectral part of excitation. In doing this the author came upon a difficulty, namely, that the commonly used perturbation-theory cannot be applied here, even if the reciprocal effect between the particles is very low. The author proves this mathematically in using a special method of the cannonical conversions. He succeeded in generalizing this nethod and making it apt for the research of the superfluidity of Fermi-systems, besides all for composing the superconductivity--theory. (Ref 2). If one leaves the macroscopic effects out of account, which are cased by the existence of the magnetic-field, the quality of the superconductivity may be regarded as the quality of superfluidity of the electron system in metals. In connection with this a very systematic investigation of the Frelich-model was made. The author emphasizes that the investigations prove the correctness of the formulae of I. Bardeen, L. N. Cooper and I.R. Schrieffer (Ref 3). There was also investigated the common scheme of the non-ideal Fermi-gas with weak reciprocal effect. It showed that in case that the attraction dominates the quality of superfluidity developes. In the result of investigations which the author made to a large extent together with D. N. Zubarev, V. V. Tolmachev, S. V. Tyablikov,

Card 2/3

Problems of the Superfluidity of Bose- and Fermi-Systems

30-58-4-3/44

D. V. Shirkov and Yu. A. Tserkovnikov he arrives at the conclusion that here we have an analogy to Bose-systems, a conclusion which largely corresponds to the works by M. R. Schafroth, S. T. Butler and I. M. Blatt (Ref 4). Finally the author mentions that at present many reasons lead to the assumption that the structure of the essential material is in some way or other similar to the structure of superconductive metals, an opinion which is also expressed by A. Bohr, Motel'son and Payns in their works. In the same way the experiments of D. I. Blokhintsev, as well as the works of A. I. Kvasnikov and V. V. Tolmachev, supply arguments for this opinion.

There are 5 references, 3 of which are Soviet.

1. Physics—Theory

Card 3/3

BOGOLYUBOV, N. N., BELEN'KIY, S. M. and LOGUNOV, A. A.

"Dispersion Relations for Weak Interactions," Nuclear Physics, 5, 1958, No. 2, January 1958. (North Holland Publ. Co., Amsterdam.

Abstract: Dispersion relations for weak interaction processes are obtained in the present paper.

It is shown that in processes which involve not only weakly interacting but strongly interacting particles as well, the dispersion relations are equivelent to the statement that the unknown amplitude functions, which are determined by strong interactions, depend only on momentum transfer between strongly interacting particles.

Joint Inst. of Nuclear Research, Laboratory of Theoretical Physics, Dubna, USSR

SOV-25-58-8-9/61

AUTHOR:

Bogolyubov, N.N., Academician, Lenin Prize Laureate

TITLE:

The Theory of Superconductivity (Teoriya sverkhprovodimosti)

PERIODICAL:

Nauka i zhizn', 1958, Nr 8, pp 17-20 (USSR)

ABSTRACT:

The author gives a historical review on the discovery of both superconductivity and superfluidity, and explains these phenomena. The latter, he states, was discovered by Academician P.L. Kapitsa in 1938. It has been proved, that the physical nature of superfluidity and superconductivity is almost one and the same. There is a profound physical and mathematical analogy between these phenomena. To characterize it shortly superconductivity is the superfluidity of electrons in metal. The theory of Academician L.D. Landau played an important role in explaining superfluidity. In 1947, the author succeeded in developing a successive microscopical theory of superfluidity and a special mathematical procedure which has been taken as a principle for solving completely the question of superconductivity. He was assisted in his works by D.N. Zubarev, V.V. Tolmachev, S.V. Tyablikov, Yu.A. Tserkovnikov and D.V. Shirkov. He explains the changes brought about by modern quantum physics in the conception of the conductivity

Card 1/2

The Theory of Superconductivity

SOV-25-58-8-9/61

of metals and refers to the works of the American scientists J. Bardin, L.N. Cooper and J.R. Shriffer as an important contribution to the problem of superconductivity. In conclusion, the author points out that the theory of superconductivity opens wide prospects for solving many important problems connected with the use of superconductors in modern engineering. There is 1 graph and 4 drawings.

1. Superconductivity--Theory

Card 2/2

SOV/30-58-8-7/43

AUTHOR:

Bogolyubov, N. N., Member, Academy of Sciences, USSR.

TITLE:

The Main Principles of the Theory of Superfluidity and Superconductivity (Osnovnyye printsipy teorii sverkhtekuchesti

i sverkhprovodimosti)

PERIODICAL:

Vestnik Akademii nauk SSSR, 1958, Nr 8, pp. 36-46 (USSR)

ABSTRACT:

Some metals loose their resistance entirely against electric current, if they are cooled to sufficiently low temperatures. This transition is characterized by a change of the electron structure in the metal. The temperatures of the phase transitions are very low. For pure metals they vary for example from 0,350K for hafnium to 80K for nichium. The phenomena of superfluidity were discovered by P. I. Kapitsa in 1938 with liquid helium which undergoes a phase transition at an absolute temperature of 2,190 and becomes superfluid. In this case the liquid helium consists of two components: one superfluid, without any viscosity, and a normal one. Research was conducted along two lines: the establishing of a phenomenological, i.e. macroscopic, and of a microscopic theory. The macroscopic theory of superfluidity was set up by F. and G. London in

Card 1/4

SOV/30-58-8-7/43
The Main Principles of the Theory of Superfluidity and Superconductivity

1935 and was improved by Pippard in 1953. The macroscopic theory of superfluidity was elaborated by Tissa in 1938 and was greatly improved by L. D. Landau in 1941. By his investigations V. P. Peshkov confirmed the accuracy of Landau's equations. The author tried to explain these phenomena by the theory of the ideal Bose-Einstein-(Boze-Eynshteyn)-gas, but comes to the conclusion, that this ideal gas does not exhibit the property of the superfluidity. In order to explain the phenomenon of superfluidity non-ideal Bose-Systems need be examined. On this basis the author elaborated a microscopic theory of superfluidity and published it more than 10 years ago. He gives a full description of his method by means of equations. Mathematically, he says, the property of superfluidity can be illustrated by the curve shown in figure 1. He observes that the phenomenon of the superconductivity can be interpreted as the phenomenon of the superfluidity of the system of free electrons in the metal. Attention is also pail to the conception of Frelikh, first mentioned by him in 1950, which he illustrated in form of a mathematical formula. In the Frelikh-Model the Hamiltonian (gamil'tonian) of the

Card 2/4

SOV/30-58-8-7/43
The Main Principles of the Theory of Superfluidity and Superconductivity

examined dynamic system consists of the sum of the effective electron- and phonon energies as well as of the Hamiltonian of the reciprocal effect which corresponds to the emission and absorption of phonons (Fig 2). New ideas came also from Shafrot, Batler and Blatt. Beginning in 1954 they developed the hypothesis of peculiar quasimolecules, which consist of 2 electrons and which obey to Bose-Statistics. The work of Kuper and Bardin and those of Shriffer in 1956 and 1957 represent a further advance in the theory of superconductivity. Still before the publication of these works in Moscow at the end of September last year the author succeeded to prove that the method of the development of the microscopic theory of superfluidity of Bose-Systems, based on the original Frelikh-Model, can be generalized for the development of the theory of superconductivity. He describes his method by means of formulae. V. V. Tolmachev, D. V. Shirkov improved the Frelikh-Model . The work by V. V. Tolmachev, S. V. Tyablikov confirm the correctness of the author's method. There are 2 figures.

Card 3/4

BOGOLYUGOV, N.N.

AUTHOR:

None Given

SOV-26-58-8-31/51

TITLE:

A General Meeting of the Academy of Sciences of the USSR

(Obshcheye schraniye Akademii nauk SSSR)

PERIODICAL:

Priroda, 1958, Nr 8, pp 112-113 (USSR)

ABSTRACT:

The June 1958 meeting of the AS USSR was concerned with important actual problems. The chief paper was delivered by the Academy's president, Academician A.N. Nesmeyanov. It dealt with the forthcoming necessary faster development of the Soviet chemical industry, especially the branch of the production of synthetic materials and their derivatives. It is intended to equal the USA's present output of these materials by 1965. This calls for the establishment of new institutes and an expansion of the research bases of the aforementioned and other sciences. The meeting was listened to by Academicians N.N. Semenov, A.E. Arbuzov, V.A. Kargin, the President AS Azerbaydzhan SSR, Yu.G. Mamdaliyev, the corresponding members of the AS USSR A.A. Imchenetskiy, and N.M. Sisakyan, and the Doctors of Chemical Sciences N.G. Titov, and R.D. Obolentsev. The attendants in the meeting also listened to the paper of Academician N.N. Bogolyubov, on the "Basic Principles of the Theory of Superfluidity and

Card 1/3

SOV-26-58-8-31/51

A General Meeting of the Academy of Sciences of the USSR

Superconductivity" and of Academician D.I. Shcherbakov, on "Some Results of the Works of the Soviet Complex Antarctic Expedition'. Bogolyubov explained the history of the theory and mentioned the relevant merits of the Dutchman Kammerling-Onnes, the Soviet physicist P.L. Kapitsa and the Italo-American Fermi. Shcherbakov mentioned that the Soviet Antarctic expedition carries out regular scientific observations on 6 cut of 24 stations established on the Antarctic continent. Interesting data on the temperature and its changes was given together with observation results of the fauna of the Antarctic coast and the distribution regularities of birds and animals. Complex oceanographic research permitted the making of a first reliable map of the coast line of the Antarctic continent which disproves the former opinion on the level or slightly wavy relief of the sea bottom there. At this general meeting the body of the Academy was supplemented by the designation of 26 academicians and 55 correspondent members. Now the AS USSR has 167 academicians and 361 correspondent members. A total of 32 foreign

Card 2/3

SOV-26-58-8-31/51

A General Meeting of the Academy of Sciences of the USSR

scientists were elected members of the Academy. There are 2 Soviet references.

- 1. Scientific research--USSR 2. Chemical industry--USSR
- 3. Antarctic regions--USSR

Card 3/3

BOBOLYUBOV, N.N.

AUTHOR: Bogolyubov, N.N. and Vladimirov, V.S.

38-22-1-2/6

TITLE:

On the Analytic Continuation of Generalized Functions (Ob analiticheskom prodolzhenii obobshchennykh funktsiy)

PERIODICAL:

Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, 1958, Vol. 22, Nr 1, pp 15-48 (USSR)

ABSTRACT:

For generalized functions  $F_r(x)$  and  $F_a(x)$  which vanish for  $x \not = 0$  and  $x \not = 0$  resp., and the Fourier transforms  $\widetilde{F}_r(p)$  and  $\widetilde{F}_a(p)$  of which are equal in a certain domain  $G^0$ , the authors prove the existence of a function of the complex variables  $k_0, \dots, k_5$  which is analytic in the domain G and is identical with  $\widetilde{F}_r(p)$ ,  $\widetilde{F}_a(p)$  for real  $p \in G^0$ . This general continuation theorem for generalized functions of several variables is needed in the proof of the fundamental theorem: Let translation-invariant generalized functions of four vectors

F<sub>ij</sub> (x<sub>1</sub>,x<sub>2</sub>,x<sub>3</sub>,x<sub>4</sub>) i,j=r,a , V = 1,2,...,1

Card 1/5

On the Analytic Continuation of Generalized Functions 38-22-1-2/6

Under transformations L from the full Lorentz group let these functions transform linearly with the aid of a certain representation A(L):

$$F_{ij}^{\nu}$$
 (Lx<sub>1</sub>, ..., Lx<sub>4</sub>) =  $\sum_{1 \le \nu' \le 1} A_{\nu,\nu'}$  (L)  $F_{ij}^{\nu'}$  (x<sub>1</sub>,...,x<sub>4</sub>)

Furthermore these functions are assumed to satisfy the follow-ing conditions:

$$F_{rr}^{\nu} = 0$$
 for  $x_1 \lesssim x_3$  or  $x_2 \lesssim x_4$   
 $F_{ra}^{\nu} = 0$  for  $x_1 \lesssim x_3$  or  $x_2 \gtrsim x_4$   
 $F_{ar}^{\nu} = 0$  for  $x_1 \gtrsim x_3$  or  $x_2 \lesssim x_4$   
 $F_{aa}^{\nu} = 0$  for  $x_1 \gtrsim x_3$  or  $x_2 \lesssim x_4$ 

The Fourier transformation

$$\left(F_{ij}^{\nu}(x_{1},...,x_{4})exp\ i(p_{1}x_{1}+...+p_{4}x_{4})dx_{1}..dx_{4}=\delta(p_{1}+...+p_{4})\widetilde{F}_{ij}^{\nu}(p_{1}..p_{4})\right)$$

Card 2/5

Card 3/5

On the Analytic Continuation of Generalized Functions is considered, where  $\widetilde{F}_{ij}^{\nu}$   $(p_1, \dots, p_4)$  are generalized functions of  $(p_1, \dots, p_4)$  defined on the manifold  $p_1^+ \dots + p_4^- = 0$ . Let the following conditions be satisfied:  $\vec{F}_{rj}^{\nu} - \vec{F}_{aj}^{\nu} = 0$  for  $p_1^2 < (M + \mu)^2$ ,  $p_3^2 < G \mu^2$ , j = r, a  $\tilde{F}_{ir} - \tilde{F}_{ia}^{\nu} = 0$  for  $p_2^2 < (M + \mu)^2$ ,  $p_4^2 < G \mu^2$ , i = r, a  $\tilde{F}_{ij}^{\nu} = 0$ , if  $(p_1 + p_3)^2 < (M + \mu)^2$  or  $p_{10}^+ p_{30}^- < 0$ , where  $M > 2\mu > 0$ . Then generalized functions  $\widetilde{\phi}_{\lambda}(z,\xi)$  of the real variable  $\xi$ can be constructed with the following properties: 1.  $\phi_{\lambda}(z, \xi)$  are analytic in  $z = (z_1, ..., z_5)$  in the domain 
$$\begin{split} |z_{1} - \mathbf{k}^{2}| & \leq \varsigma \, \mu^{2} \, , \, |z_{2} - \mathbf{k}^{2}| \leq \varsigma \, \mu^{2} \, , \, |z_{3} - \widetilde{\tau}| \leq \varsigma \, \mu^{2}, \\ |z_{4} - \widehat{\tau}| & \leq \varsigma \, \mu^{2} \, , \, |z_{5} + \alpha^{2}| \leq \varsigma^{2} \, \mu^{2} (\frac{\mathtt{M}}{\mathtt{t}})^{2} \, , \, \, \forall \, \leq \tau \leq \mu^{2} \, , \end{split}$$

On the Analytic Continuation of Generalized Functions

38-22-1-2/6

$$0 \leqslant k \leqslant 2 \sqrt{2} \mu$$

$$2. \stackrel{\leftarrow}{\phi}_{\lambda}(z, =) = 0 , \text{ if } 5 < (\frac{M+\mu}{2})^2$$

3. for real  $(p_1 \cdot p_4)$ ,  $p_1 + \cdot \cdot \cdot + p_4 = 0$  for which the magni-

tudes 
$$z_1 = p_1^2$$
,  $z_2 = p_2^2$ ,  $z_3 = p_3^2$ ,  $z_4 = p_4^2$ ,  $z_5 = (p_1 + p_2)^2$ 

satisfy the conditions (1), and for  $\xi = (\frac{p_1 + p_3}{2})^2$  it holds for

 $p_{10} + p_{30} > 0$  the representation

$$\tilde{\mathbf{F}}_{ij}^{\gamma}(\mathbf{p}_{1},...,\mathbf{p}_{4}) = \sum_{i=1}^{\alpha} \mathbf{p}_{i_{1}}^{\alpha} ... \mathbf{p}_{i_{8}}^{\alpha} \widetilde{\phi}_{\lambda}(z,\xi)$$

with a finite number of terms in the sum. This theorem can be applied in theoretical physics to the establishment of dispersion relations [Ref 1,2]. There are 13 references, 8 of which are Soviet, 3 French, and 2 English.

Card 4/5

On the Analytic Continuation of Generalized Functions

38-22-1-2/6

ASSOCIATION: Matematicheskiy institut imeni V.A. Steklova Akademii nauk

SSSR (Mathematical Institute imeni V.A. Steklov, Academy of

Sciences, USSR)

SUBMITTED:

June 17, 1957

AVAILABLE:

Library of Congress

1. Functions-Analysis 2. Fouriers series-Applications

Card 5/5

BOGOLYUPOV NN

· AUTHOR:

Bogolyubov N . Academican

29-4-3/20

TITLE:

Another Secret of Nature Reversed (Raskryta yeshche odna zagadka prirody). The Theory of Superconductivity (Teoriya

sverkhprovodimosti)

PERIODICAL:

Tekhnika Molodezhi, 1958 Vol. 26, Nr 4, pp. 5-7 (USSR)

ABSTRACT:

The Dutch scientist Kamerling Onnes made a strange discovery, 50 years ago. The superconductivity which he discovered, consists in the fact that some metallic conductors when cooled down to very low temperatures, offered no resistance to the current conducted through them. A great number of investigations was made since that time for finding out the reason for this secret. Some time later, the German researcher Meyssner succeeded in clarifying some extremely interesting magnetic properties of the superconductor. Also the scientists F. and G. London were successful in this field. The English scientist G. Frelikh contributed substantially to the clarification of some properties of the superconductor in 1950. The English scientists Shafrot, Batler and Blatt developed a new and important physical idea. They recognized the importance of the socalled correlation for the clarification of

Card 1/3

Another Secret of Nature Reverse . The Theory of Superconductiv29-4-3/20 ity.

superconductivity. Also the American scientists Bardin, Kuper and Shriffer started from the importance of the interaction of electrons and phonons. Yet they also did not succeed in solving the corresponding equation. A new method concerning the "new method in the theory of superconductivity" was elaborated by the author and his assistants D. N. Zubarev, V. V. Tolmachev, S. V. Tyablikov and Yu. A. Tserkovnikov. This method is based on the development of the idea of the microscopic theory of superviscosity which was published still 10 years ago. The phenomenon of superviscosity was discovered in 1938 by P. L. Kapitsa, Member of the Academy. Investigating liquid helium, he observed that the viscosity of helium disappears at temperatures close to the absolute zeromark. The theory by the Member of the Academy L. D. Landau played an important role in clarifying this phenomenon. The author succeeded in developing a logical microscopic theory of the superfluidity and to elaborate special mathematical processes serving as basis for the new method. This method made it possible to solve the problem of superconductivity completely. It was found that a superfluid liquid shows a high degree of well regulation. This is caused by an intense interaction of the particles.

Card 2/ 3

Another Secret of Nature Revealed . The Theory of Superconductivity.

29-4-3/20

The greatest difficulty was the compution of this interaction. The same difficulty was met in establishing the theory of superconductivity. An analogy of the two phenomena was found. By this it was proved that the superconductivity is nothing but the superviscosity of the electrons in the metal. It would be wrong to assume that the scientists are no longer interested in this problem since its solution. On the contrary, since the fundamental mechanism of this phenomenon is known, new practical problems result from it. The author hopes that this new method will be applied also in other fields of statistic physics, in first line in the theory of netals. There are 5 figures.

AVAILABLE:

Library of Congress

- 1. Superconductivity-Temperature factors 2. Superconductivity-Theory 3. Conductivity-Temperature factors
- 4. Resistance-Effects of temperature

Card 3/3

BOGOLYUBOV, N.N., akademik.

Problems in the theory of superfluidity of Hose and Fermi systems.

Vest. AN SSSR 28 no.4:25-29 Ap 158. (MIRA 11:5)

(Fluids) (Electric conductivity)

BOGOLYUBOV, N.N., akademik

Fundamental principles of the theory of superfluidity and superconductivity. Vest. AN SSSR 28 no.8:36-46 Ag '58. (MIRA 11:9) (Electric conductivity) (Helium)

BORDLYUBOV. N.N.

AUTHOR:

Bogolyubov, N. N.

56-1-10/56

TITLE:

A New Method in the Theory of Superconductivity, I. (O novom metode v teorii sverkhprovodimosti. I).

PERIODICAL:

Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 1, pp. 58-65 (USSE)

ABSTRACT:

In the present paper the method of canonical transformation, as previously worked out by the author for the theory of superfluidity, is generalized. By means of this method it is possible to construct a consistent theory of the superconducting state, To simplify the representation the author proceeds from the model suggested by H. Fröhlich (reference 1). This model does not contain the Coulomb interaction in an explicit form, and the Hamiltonian which is characteristic of the dynamic system is given in an explicit form. The ordinary perturbation theory with regard to the powers of the coupling constant cannot be employed in this case. Therefore the author previously works out a certain canonical transformation. In this connection different considerations are mentioned. The choice of the canonical transformation must guarantee the mutual compensation of the

Card 1/3